U.S. Department of Agriculture Science and Education Administration
October 1980

Agricultural Research

T. W. Edminster — Mr. Ag Research

Talcott W. Edminster retired from USDA at the end of February 1980.

Although he underwent surgery for cancer in the spring of 1979, followed by radiation and chemotherapy treatments, he had been back on the job for some months before he retired.

Now at home and doing well, Edminster keeps up his interest in and support of agricultural research programs—thanks to frequent phone calls, visits, and correspondence with many business associates and friends.

His activities these days are interspersed with time to relax with family and friends. And the stereo set retirement gift from staff and friends provides hours of enjoyment as he listens to his favorite music.

Since Edminster had been their source of leadership for a good many years, scientists and other employees of "the world's largest agricultural research organization" still affectionately think of him as "Mr. Ag. Research." And they are, of course, concerned about his health and well-being.

He had been "a part of the team" since his early bench scientist/engineer years, having first joined the federal service in the Soil and Water Research program of the Soil Conservation Service in 1944. This unit later became a part of the newly established Agricultural Research Service (ARS) in 1953.

During the next 18 years, Edminster's leadership in research administration resulted in his steady upward progress, culminating in 1971 with his appointment as the Administrator of ARS —which today is that part of USDA's Science and Education Administration known as Agricultural Research.

One of the greatest achievements in his career (to date) came shortly after his appointment as administrator of ARS. It was his success in directing the most extensive organizational changes in the history of USDA's agricultural research programs. Edminster not only contributed directly in

the planning of the 1972 ARS reorganization, but he also personally directed the ways it would take place.

Edminster recognized it as a major transition time for the people of the agency, and amid all the mass of details involved in such change, he established vital lines of communication with all employees. In keeping with his usual practice and style, he held a series of meetings to communicate with employees and employee organizations. Giving ample opportunity for questions and answers, such meetings, together with other opportunities for interaction, produced a high level of morale and a willingness to cooperate in making the reorganization a total success.

His strong and dedicated leadership held the agency together as a cohesive unit during the transition, with minimum interruption to ongoing research programs. The multidisciplinary team approach—that he had once successfully applied to soil and water research problems—became a part of the "new ARS."

He established a regionalized line management system that transferred much decisionmaking responsibility to

(continued on page 16.)

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Photo p. 13 courtesy
Leonard Lee Rue III.

Art p. 14 by Lisa Bell.

Cover: This 20′ diameter by 30′ tall Darrieus vertical axis wind turbine is part of SEA's wind-powered irrigation research at Garden City, Kansas. Capable of producing 10 horsepower in a 25 mph wind, wind turbines could replace many of the fossil fuels used to power irrigation pumps on the Great Plains. Our article begins on page 4 (0880W892-31A).

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Wind-Powered Irrigation Pumping on the Great Plains

It's not an altogether ill wind that blows on the Great Plains, even if it does dry topsoil, blow dust, and drift snow. It's a free, capturable energy source for irrigation on the farm.

SEA researchers say wind turbines—wind energy driven, late 20th century versions of the windmill—could replace more than half of fossil fuels used for farm irrigation pumping on the Great Plains. The saving, with the present mix of surface and sprinkler irrigation, could be in excess of 18 billion kilowatt-hours of energy annually.

The harnessable wind energy on the Plains is tremendous. At about 16 feet (5 meters) above ground surface, an average wind energy of 200 to 500 watts per vertical square meter moves across the ten states—extending from Montana and North Dakota south to Texas and New Mexico.

Except for windmills providing water to homes and livestock for a century and wind-chargers generating electricity on farms 40 years ago, the Plains' wind energy has remained virtually untapped for agricultural use.

Wind turbines proved promising alternatives to conventional irrigation pumping systems in SEA tests at Bushland, Tex., (*Agricultural Research,* January 1979, pp. 3-4) and Garden City, Kans.

SEA agricultural engineers Lawrence J. Hagen and Leon Lyles and soil scientist Edward L. Skidmore, Manhattan, Kans., then investigated large-scale application of wind energy to Great Plains irrigation pumping. Almost 20 million acres (8 million hectares) are irrigated there with water pumped on farms and ranches.

"We estimate that wind turbines could supply 60 to 70 percent of current demand for surface irrigation," Hagen says, "and 30 to 45 percent of the energy used for sprinkler irrigation, depending upon crop and location."

The estimates are for wind turbines with variable ratio transmissions and auxiliary motors, and devoted exclusively to irrigation pumping without energy storage.

Adding an auxiliary motor requires

Opposite page: Surrounded by Kansas farmland, this wind turbine pumps water from the tail-water pit (background) to the fields and the reservoir (foreground). Ditches at the downstream end of irrigated furrows channel runoff water back to the pit for repumping. When wind speed drops, the reservoir provides enough water to ensure a nearly constant flow through gated pipes (0880W887-16).

Above: Water meter, located at the base of the turbine, tells SEA agricultural engineer Lawrence Hagen how much water is being pumped from the tail-water pit through gated irrigation pipes. Depending on wind speed, the turbine can pump up to 600 gallons per minute into nearby test fields (0880W892-22A).

This grain sorghum field is irrigated periodically with a 4-inch water application. Kansas State research assistant Muhammad Sharif (left) and Lawrence Hagen adjust the water flow rate on gated pipes at the head of each furrow (0880W891-20).

fossil fuel and increases capital costs, Hagen acknowledges.

But an overriding advantage is that motors increase the area that can be irrigated by each well in summer, and thus increase the area that can be preplant irrigated in other seasons when wind energy is more plentiful. Hagen says the wind turbine with an auxiliary motor uses 10 to 20 percent more annual available wind energy on summer-irrigated crops than a wind-alone system.

For sprinkler irrigation, which requires a relatively constant flow of water, the auxiliary motor would be sized to equal the rated power of the wind turbine. For surface irrigation, the motor would have 0.4 the rated power of the turbine.

Hagen and associates developed a computer program for matching wind turbine size to well and aquifer characteristics. They found that two wind-powered wells would be needed to yield the same amount of water as a conventional well in the proposed surface irrigation system.

Cropping, irrigation management, and location will influence the proportion of capturable wind energy that can be utilized for pumping water, Hagen says.

Fully irrigated corn with preplant irrigation would use about 30 percent of available annual wind energy at Amarillo, Tex., he calculates, and about 45 percent at Garden City, Kans., or Columbus, Nebr. Less than 25 percent would be used without preplant irrigation. Wind energy use would be slightly higher with sorghum or with cotton on the South Plains.

With limited irrigation of crops adapted to dryland farming, 50 to 100 percent of annual wind energy could be used. More than half of the Great Plains irrigated land is planted in corn, a fourth in hay and pasture, and smaller amounts in small grains, sorghum, cotton, and other crops.

Dr. Lawrence J. Hagen is located at the SEA Wind Erosion Research Unit, 204 Waters Hall, Kansas State University, Manhattan, KS 66506.—(By Walter Martin, SEA, Peoria, Ill.)

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Plant Nutrients Move in Solution— Not in Sediment

In the humid Midwest, most plant nutrients lost from pasture lands are in solution rather than attached to sediment particles, say researchers at the SEA North Appalachian Experimental Watershed in Ohio.

Soil scientist Lloyd B. Owens reported on the first 4 years of information collected in a 5-year study of nutrient losses from nine small-pastured watersheds near Coshocton, Ohio. He says most of the nitrogen, 75 to 100 percent, and 85 to 100 percent of the phosphorus, moved off the pastures in solution.

Owens found that about 80 percent of the nitrogen and 67 percent of the phosphorus moved off during November to April, the winter dormant growth period when cattle are fed hay on the pastures. He compared that period to May to October when the remainder of the nitrogen and phosphorus was lost.

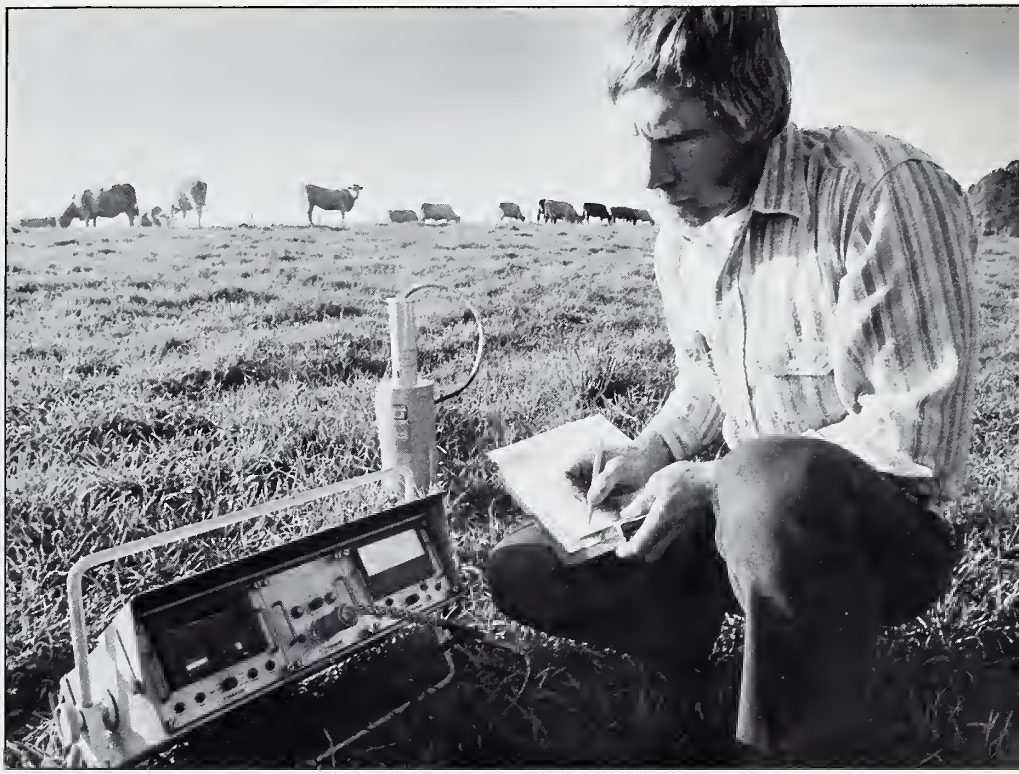
The total nutrients lost are not large however, Owens says. Mineral nitrogen losses ranged from 14 to 30 pounds per acre per year. Total soluble phosphorus losses ranged from 0.5 to 2.3 pounds per acre per year.

"Since normal rainfall would add an average of about 19 pounds of mineral nitrogen and 0.5 pounds of phosphorus per acre per year, the losses we measured were minor," Owens says.

Two fertilizer treatments were used on the one- to seven-acre pastures. Some received 50 pounds of nitrogen per acre applied in the spring, others received 200 pounds per acre applied in three equal amounts throughout the growing season. There was no significant difference in nitrogen losses between the two application levels.

Owens cooperated with Robert W. Van Keuren of the Ohio Agricultural Research and Development Center, Wooster, Ohio, in the study.

Dr. Lloyd B. Owens is located at the SEA North Appalachian Experimental Watershed, Rt. 621, P.O. Box 478, Coshocton, OH 43812.—(By Ray Pierce, SEA, Peoria, Ill.)



Above: The amount of water which runs off a soil surface is influenced by the change in water stored in the soil. Hydrologic technician Harold Frank uses a neutron probe to determine the soil moisture at various depths in a pastured watershed near Coshocton, Ohio (1078X1339-31).

Left: Surface runoff samples, proportional to total runoff from the watershed, are collected and analyzed for the soluble and sediment attached nutrients. Following storm runoff, hydrologic technician Harold Frank resets the sampler which automatically collects multiple samples throughout a storm (1078X1139-30).

Heat Kills Mycobacteria in Wieners and Sausages

Biological lab technician Diana Whipple records number of *Mycobacterium avium* and *Mycobacterium intracellulare* colonies surviving exposure to various temperatures (0780W801-15).

A 99.9999999999 percent kill—that's what happens to two tuberculosis-causing disease agents *Mycobacterium avium* and *Mycobacterium intracellulare* if they are present in wieners processed to a temperature of 160 °F (71.1 °C) for at least 2 minutes.

These mycobacteria are rarely present in swine carcasses at slaughter, and such carcasses are passed by federal or state inspectors only for processing by cooking.

Studies by SEA microbiologist Richard S. Merkal at the National Animal Disease Center, Ames, Iowa, on heat inactivation of these agents in wieners and sausages were partially funded by the USDA Food Safety and Quality Service (FSQS). The research provides FSQS with scientific evidence for consideration in developing regulations enforced at federally inspected meat-processing plants.

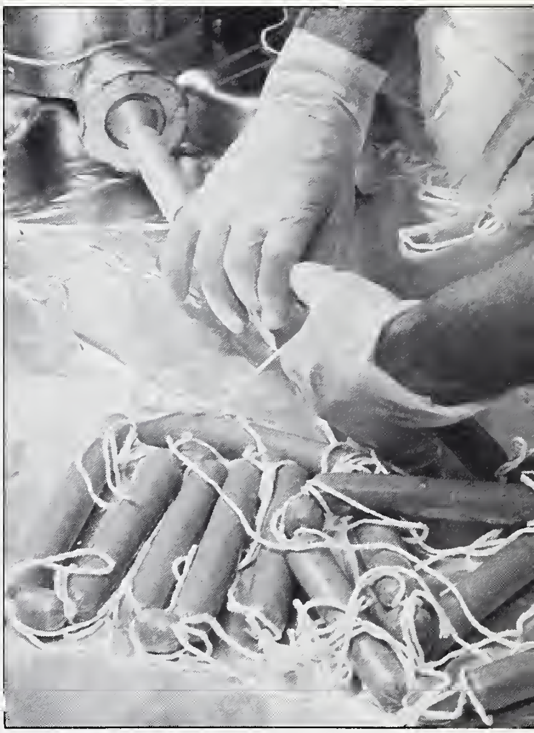
The research was conducted under strict safety protocol in an isolated laboratory equipped to process wieners and sausages by commercial methods.

Merkal found that a very long exposure at 140 °F (60 °C) will kill these mycobacteria in processed meats, but exposure time for inactivation need be very short at 158 °F (70 °C). Processing wieners at 160 °F for 2 minutes would provide an extra margin of safety.

Merkal used the most heat-resistant mycobacteria representative obtainable in his studies. He added laboratory-grown mycobacteria to meat in numbers sufficient to count viable organisms after 99.999 percent had been killed by heat. Naturally infected tissues do not contain enough organisms for accurate estimates.

The meat's peak temperature, exposure time, saline-soluble protein component, and pH, as well as relative humidity and temperature difference between the meat and the smokehouse, all affect percentage kill or heat tolerance of mycobacteria, Merkal found. Sodium nitrate added to meat had no effect on heat tolerance.

Effects of exposure time and relative humidity were seen when wiener processing conditions were varied. With slow heating and high



humidity, 99.999 percent of the viable organisms were killed at a peak temperature of 154.9 °F (68.3 °C).

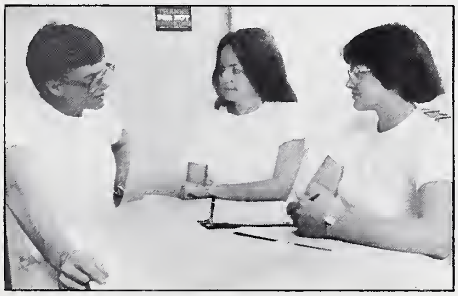
Commercial wiener processing involves convection heating with moderately high humidity and gradually approached peak temperatures, Merkal says.

The wieners are therefore within the killing range of temperatures for some time before the peak temperature is reached.

Precooked sausages ordinarily receive short, moisture-reducing heat exposure, either in hot oil or near radiant heating. They are then rapidly chilled and frozen with a refrigerated blast of air or carbon dioxide.

Temperature of these sausages are within killing range only a short time under usual commercial processing procedures. So, for sausages, Merkal recommends a peak temperature of 167 °F (75 °C) with a heating period of at least 5 minutes above 140 °F (60 °C) —and at least 2 minutes at 160 °F or more—to inactivate 99.9999999999 percent of the mycobacteria.

Dr. Richard S. Merkal is located at the National Animal Disease Center, P.O. Box 70, Ames, IA 50010.—(By Walter Martin, SEA, Peoria, Ill.)



Upper left: Wieners—incorporating mycobacteria during the emulsion process—are prepared from a mixture of lean beef, lean pork, pork fat, ice, salt, sugars, and spices (0780W804-24), then stuffed into cellulose wiener casings.

Upper right: Links are formed by tying with cord (0780W803-12).

Left: For each cooking cycle, researchers insert thermocouples to monitor internal temperature of wieners and sausages subjected to various temperatures (0780W803-25).

Bottom: SEA microbiologist Richard Merkal, biological lab technician Judy Crawford (center), and Diana Whipple review data on the three factors which determine the number of organisms killed—peak internal temperature, time within the killing range, and relative humidity (0780W803-36).

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Nitrogen Fixation in Grassy Crops

Rice plants grown at the Cell Culture and Nitrogen Fixation Laboratory, Beltsville, Md., are helping scientists detect nitrogen fixation by other grassy crops. SEA plant physiologist Charles Sloger measures for nitrogen-fixing "activity." (0180X095-22A).

Rice experiments at the SEA Cell Culture and Nitrogen Fixation (CC&NF) Laboratory, Beltsville, Md., are renewing hopes that farmers will one day grow varieties of rice, corn, wheat, and other grasses that get nitrogen fertilizer from nitrogen-fixing microorganisms.

"Developing so-called nitrogen-fixing grassy crops is still a laboratory pipe dream, but one that, if fulfilled, could help feed much of the world's hungry and malnourished," says Charles Sloger, a plant physiologist with the CC&NF lab.

Sloger and Peter van Berkum, a cooperating biochemist from the University of Maryland, have detected and measured small amounts of nitrogen-fixing "activity" on the roots of rice plants growing in the lab greenhouse in Beltsville. Rice is the world's number one staple crop, but like other grassy crops, it usually gets nitrogen fertilizer artificially through chemicals applied directly to the soil.

Sloger, van Berkum, and other scientists interested in developing nitrogen-fixing grassy crops base their research on the fact that some natural nitrogen-fixing systems already exist.

Millions of years ago, plants called legumes formed fertilizing partnerships with certain soil bacteria. Legumes gave the bacteria room and board in root tissues in exchange for the abilities of the bacteria to provide or fix nitrogen for plant growth and development. Several legumes—soybeans and other beans, peas, peanuts, alfalfa, and others—are now prolific food crops.

Legumes, however, provide much less food than grasses, which cover ten times more of the world's acreage. Grasses get little or no help from soil microbes.

The questions then for Sloger, van Berkum, and other scientists are: Can modern agricultural research tools be used to develop a fertilizing partnership between grassy crops and soil microorganisms? Can researchers concentrate the natural evolution that led to nitrogen-fixing legumes into a relatively few years of plant breeding,

genetic engineering, and field studies to develop auto-fertilizing grassy crops?

Although the answer is not yet apparent, at Beltsville things are looking up. The rice plants in the Beltsville experiments were grown in salt marsh sediment which Sloger and van Berkum brought from the nearby Chesapeake Bay. They first discovered that marsh sediment somehow stimulates nitrogen fixation on an aquatic grass called Spartina. They don't yet know what kind of microbe is responsible for the nitrogen fixation.

Van Berkum and Sloger's findings could mean that for the first time scientists will have a solid foundation of lab procedures on which to begin the breeding programs needed to produce nitrogen-fixing rice and other grasses.

According to the SEA scientists, research on nitrogen-fixing grasses has faltered in recent years because researchers have failed to detect fixation on roots fresh from grass plants. With previous experiments, an overnight incubation period was needed before researchers could detect fixation. Van Berkum and Sloger—who say the long incubation ruins the credibility that nitrogen fixation does occur in grass roots—recently became the first to detect the enzyme actions associated with nitrogen fixation on fresh grass roots.

"We hope the methodology we are working out to identify primitive nitrogen-fixing systems in grasses will give scientists a new awareness of where and how to look for nitrogen fixation in native and cultivated grasses," says van Berkum.

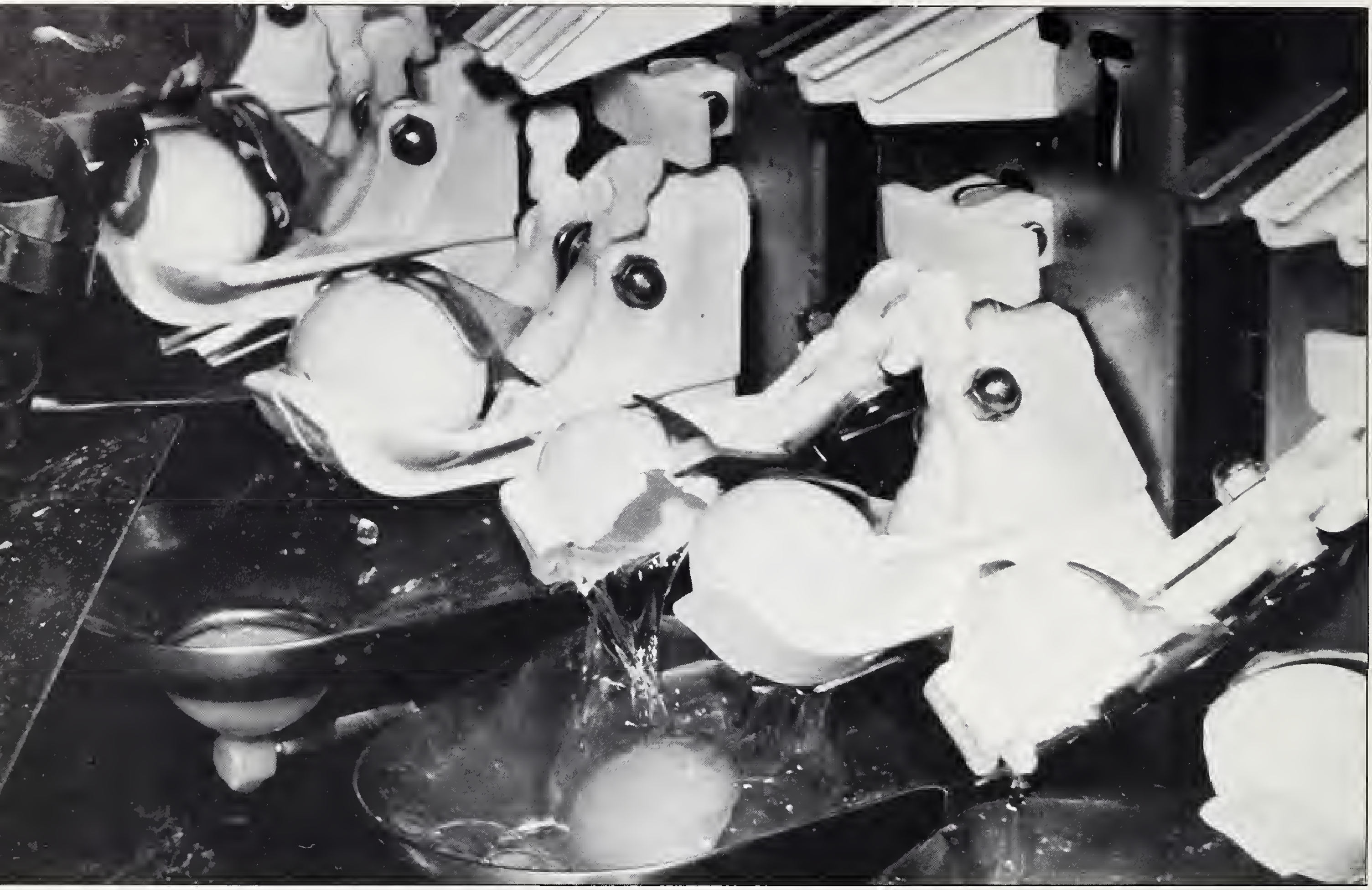
After traces of natural nitrogen fixation are identified on grass roots, the next step is to enhance and improve the system for use on commercial crops. Here, too, van Berkum and Sloger are doing essential ground work. They have discovered that certain physiological conditions in plants seem to favor nitrogen fixation. The conditions include certain stages of plant development, light, temperature, soil pH, reduced levels of oxygen and its supply, and low levels of chemical fertilizer nitrogen.

"Research on nitrogen fixation is one method of helping reduce modern agriculture's dependence on artificial fertilizers," says Sloger. "The industrial processes used to produce fertilizers require large amounts of fossil fuels. Also, small farmers in the third world would benefit from auto-fertilizing grasses because most can't afford current high prices for fertilizers."

Dr. Charles Sloger and Dr. Peter van Berkum are located at the SEA Cell Culture and Nitrogen Fixation Laboratory, Rm. O, Greenhouse 16, Range 1, BARC-West, Beltsville, MD 20705.—(By Stephen Berberich, SEA, Beltsville, Md.)

Peter van Berkum, cooperating scientist from the University of Maryland (left), and Charles Sloger transplant rice seedlings into salt marsh sediment taken from Maryland's Chesapeake Bay. They have found that the sediment stimulates nitrogen fixation on the roots of rice and marsh grasses (0180X096-20).

Humidity and Eggshell Strength Linked



SEA research linking humidity to eggshell breakage could help industry reduce breakage losses (0171A82-6).

The moisture level in the air—not the temperature of the air—is a critical factor affecting the breaking strength of eggshells.

Egg breakage during handling and processing is a continuing problem for the poultry industry. Losses due to breakage are estimated at $70 million annually in the United States. By keeping the relative humidity as low as possible or by handling eggs when eggshell moisture is low, the egg industry should be able to reduce breakage losses.

Berry D. Lott, SEA animal husbandman, and Floyd N. Reece, SEA agricultural engineer, researched the effects of temperature and air moisture on eggshell strength. In two experiments of three trials each, 160 eggs were collected from a flock of young hens.

In the first experiment, the eggs were held for 24 hours in a chamber that had a temperature of 40°F (4.4°C) and a relative humidity of 40 percent.

In the second experiment, the eggs were held in another chamber for 24 hours at the same temperature, but with a relative humidity of 80 percent.

The eggs from both chambers were then removed, randomized, and placed in chambers with various combinations of temperature and humidity.

After 20 hours, the eggs were broken on a testing machine that measures eggshell strength.

The scientists learned that eggshell breaking strength is determined by the dewpoint temperature—the temperature at which water vapor condenses—rather than temperature per se. They concluded the relative humidity of the environment is the critical factor—not the temperature.

Lott and Reece believe that changes in eggshell breaking strength are caused by changes in eggshell moisture, accompanied by changes in temperature after eggs are laid. This moisture is directly influenced by the relative humidity.

Dr. Berry D. Lott and Dr. Floyd N. Reece are located at the SEA South Central Poultry Research Laboratory, P.O. Box 5367, Mississippi State, MS 39762.—(By Bennett Carriere, SEA, New Orleans, La.)

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Rangeland— Home for Both Cattle and Wildlife

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Range ecologists and managers in Texas are concerned about the land's ability to endure sustained multiple use by wildlife and cattle.

SEA range scientists have identified the eating habits of javelina, also known as collared peccary, and white-tailed deer, finding them compatible with those of cattle and not detrimental to the rangeland.

"The wildlife mainly eat cacti and forbs (herbs). In contrast, cattle rely mainly on grasses for the bulk of their diet," says SEA range scientist James H. Everitt, Weslaco, Texas. "By identifying what plants javelina and white-tailed deer eat, we can do a better job of managing the land and providing for their feeding needs.

"And, with few public hunting preserves in the state, this information will benefit Texas ranchers who supplement their income by leasing hunting rights on their land for $3.00 to $3.50 per acre," says Everitt. According to Texas Park and Wildlife Department statistics, more than $200 million was spent in 1979 for licenses, equipment, and related needs to hunt white-tailed deer. Another $2.2 million was spent hunting javelina.

Everitt, SEA range scientist Candelario L. Gonzalez, and biological technicians Mario A. Alaniz and Gerardo Latigo, studied javelina and white-tailed deer, analyzing the animals' populations, food availability, food habits, and nutrient content of their diets.

Scientists analyzed the botanical composition of feed found in the stomachs of wildlife killed by hunters in four Texas counties—Starr, Kenedy, Willacy, and Hidalgo. By comparing botanical feed composition with known plant species in the counties, the scientists determined which species are eaten by wildlife and which are available for cattle.

The research revealed that javelina diets in Starr County consisted of 92.8 percent cacti, 4.7 percent forbs, 0.6 percent grass, 1.7 percent unknown plant material, and 0.2 percent unknown animal material.

Javelina and other wildlife roam Texas rangelands mainly eating cacti and herbs—leaving grasses available for cattle.

In Kenedy and Willacy County, cacti comprised 46.5 percent by volume of the javelina diet, forbs 41.7 percent, browse 2.0 percent, grass 5.4 percent, unknown plant material 4.1 percent, and unknown animal material 0.3 percent.

Pricklypear cactus is the most preferred food of javelina on south Texas rangelands. However, in areas of low pricklypear density, forbs are highly preferred and comprise a significant portion of the diet.

In white-tailed deer diets in Hidalgo County, cacti comprised 61.2 percent of the diet, browse 16.5 percent, forbs 12.3 percent, grass 3.0 percent, and unknown matter 7.0 percent. In Kenedy and Willacy counties, cacti comprised 4.3 percent by volume of deer diets, forbs 37.8 percent, browse 26.9 percent, grass 24.8 percent, and unknown matter 6.2 percent.

The nutritional requirements of white-tailed deer are probably met more readily in Kenedy and Willacy counties because of the greater availability and utilization of forbs, which are higher in nutrition than pricklypear cactus. In Hidalgo County, the high dry matter digestibility of pricklypear makes up somewhat for its lower nutritional value.

Range scientists James H. Everitt and Candelario L. Gonzalez are located at the SEA Fruit Vegetable Soil & Water Research Laboratory, P.O. Box 267, Weslaco, TX 78596.—(By Eriks Likums, SEA, New Orleans, La.)

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History of Amaranth

Amaranth's long association with man is probably due to the plant's ability to adapt readily to new environments created by people. Just as the North American pigweed—a wild amaranth—quickly invades a freshly turned home garden, ancestor plants of amaranth probably kept close to early tribes of Central America by gaining hold on disturbed soil.

Mayan Indians of Mexico's distant past developed amaranth into high yielding crops. Then the Aztecs made amaranth into more than their main food staple. The plants became deeply woven into the religious and ceremonial fabric of Aztec culture.

Taking the Mayan notion that amaranth has magical or supernatural powers, the Aztecs constructed idols of multiple deities from amaranth, and great quantities of amaranth grain was paid in tribute each year to the Aztec king, Montezuma.

Amaranth was destroyed as a major crop, however, when Cortez invaded and plundered the Aztec civilization in the 16th century. Cortez reasoned that complete devastation of his enemy could only be achieved by eliminating amaranth, which typified Aztec culture.

Yet, amaranth survived. The grain is still grown in Mexico, where people add it to flour for making tortillas and other foods. The grain is also popped, much like popcorn, and made into confections.

Many other cultures in tropical and semitropical areas in Africa and the Far East have developed varieties of leafy amaranths. These vegetable amaranths are considered among the best tropical greens.

The word amaranthus comes from two Greek words meaning "immortal" and "not withering." After falling into relative obscurity at the hand of Cortez, amaranth's return makes true the promise of its name. Research gained momentum in the last couple of years and interest in amaranth is high among home gardeners.

Current research includes studies by the SEA Cereal Products Research Unit at the Western Regional Research Center in Berkeley, Ca., on the potential of amaranth grains.—(By Stephen Berberich, SEA, Beltsville, Md.)

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Amaranth— A Hot Weather Spinach Substitute

Eight thousand years after man first grew it as a crop, amaranth is still enjoyed. In recent taste tests at SEA's Beltsville Agricultural Research Center in Maryland, most of 60 people polled said amaranth tastes as good as spinach when cooked.

Testing 60 people hardly provides scientific proof that Americans would prefer amaranth greens to spinach. However, as part of USDA's New Crops Program, the tests suggest that amaranth may have resurfaced as a hot weather spinach substitute, and also as a high-protein grain crop.

Field tests by SEA research agronomist Austin Campbell indicate that certain varieties of amaranth would make excellent vegetable crops, with up to three crops a season. Unlike spinach, which requires cool weather, amaranth does best in mid-summer heat. Leaves of spinach-like flavor can be harvested just 30 days after planting amaranth seeds, says Campbell.

Campbell is testing 19 leafy amaranths. These leafy types plus high-protein grain types are being rediscovered by today's agricultural scientists. Amaranths are actually among the oldest crops of the New World, dating from about 6000 B.C.

In a world faced with increasing hunger and malnutrition, Campbell and other SEA researchers are focusing on such forgotten crops in an effort to "diversify our farming systems." Diverse systems, with many crops of special attributes, says Campbell, "are less vulnerable to plant disease and insect epidemics than large monoculture cropping systems—and may lead to a more productive agriculture."

Amaranth's special attributes include:

—*Good nutritive value.* Amaranth contains high amounts of good quality protein and essential minerals. Amaranth grain contains a better balance of amino acids than corn, wheat, rice, or other popular grains. Foods with well-balanced amino acids—the building blocks of proteins—help the body produce necessary proteins.

—*Efficient growth and versatility.* Amaranth is very efficient in terms of converting the raw materials of sunlight, soil, and water into plant tissues, proteins, and vitamins. Amaranth can be grown anywhere spinach grows and is adaptable to many different climates.

—*Improved plant breeding potential.* The large Amaranthus plant family is a rich pool of genetic traits. Amaranths offer breeders more genetic diversity in their present undeveloped state than many widely grown crops. Breeders could, for example, raise already high levels of leaf proteins.

Serious study of amaranth as a potential U.S. crop began 7 years ago when Rodale Press' Organic Gardening and Farming Research Center in Emmaus, Pa., started what has become an extensive project on amaranth cultivation, breeding, and nutritive value.

Dr. Austin Campbell is located at the SEA Germplasm Resources Laboratory, Room 326, Building 001, BARC-W., Beltsville, MD 20705.—(By Stephen Berberich, SEA, Beltsville, Md.)

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Beetle Biocontrol in Livestock Diseases

The feeding habits of a beetle from Africa and Asia aid in the biological control of horn and face flies as well as internal parasites of livestock, say SEA entomologists G. Truman Fincher and Richard R. Blume.

By burying livestock droppings, the dung-feeding beetle, *Onthophagus gazella*, is also enriching pastures in Texas, Georgia, and California.

"During peak months of beetle activity—July, August, and September—beetles bury 82 to 88 percent of the cattle droppings in a pasture within 1 week," says Fincher.

In this way, the beetle destroys the breeding habitat of horn and face flies and buries eggs of internal parasites of cattle deep in the soil. Most of the tiny worms cannot return to the pasture surface when they hatch. This decreases the chance of grazing livestock becoming infested with internal parasites.

"The beetle also alleviates fouling of grazing land while it improves the soil," says Fincher. "Fouling by cattle feces is detrimental to good pasture use, and the dung beetle helps solve that problem. Cattle feces are very good fertilizer, and buried, they improve the texture and fertility of the soil."

In related research, other species of dung-feeding beetles, including some from Argentina, Egypt, Pakistan, and Hawaii, are being studied to evaluate their potential for biological pest control.

Dr. G. Truman Fincher and Dr. Richard R. Blume are located at the SEA Veterinary Toxicology and Entomology Research Laboratory, College Station, TX 77840.—(By Bennett Carriere, SEA, New Orleans, La.)

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T.W. Edminster—Mr. Ag. Research

(Continued from page 2.)

geographic areas where the work was being done. It was a new way to obtain administrative decisions more quickly and at a level close to the problems needing research answers. It materially improved the effectiveness of the state-federal cooperative research concept.

Edminster maintained close contacts with industry, commodity groups, and land-grant university officials, including the leaders of the state agricultural experiment stations. His close communication with these key cooperators during the reorganization was vital to the development of the unified national agricultural research program we know today.

Edminster also developed rapport with foreign research organizations, and helped guide their research in directions complementary to U.S. research activity.

Those leadership achievements gained him USDA's highest recognition—the Distinguished Service Award—in 1973.

The many other awards he received throughout his career include: the USDA Superior Service Award; the government-wide William A. Jump Award in 1951; and the Career Service Award presented in 1975 by the National Civil Service League—an award to honor career civil servants with a record of integrity and devotion to the principles of public service. In 1979, the French Minister of Agriculture presented him an order of merit award, "Officer du Merite Agricole."

His reorganization skills, used so successfully in 1972, were called upon again in 1977 when a department level reorganization created the Science and Education Administration.

An active member of numerous professional organizations and honorary societies, Edminster is currently the president of the International Commission of Agricultural Engineering. He is the co-author of two college textbooks on soil and water engineering, and has produced many scientific and technical papers.

Away from the office, prior to retirement, his personal interests ranged from sailing and rifle marksmanship to bridge. Also, he and his family enjoyed the outdoors as avid campers and as experts in the training and care of riding horses.

Today, from his home in College Park, Maryland, T. W. Edminster reports that: "While the additional surgery and treatments have somewhat limited my ability to get around and attend some of the meetings and group discussions that I would like to participate in, they have not limited my interest or ability to keep up my contacts in other ways.

"One of the most satisfying rewards I have had is to see the continued progress that SEA-AR is making in addressing and solving the myriad of problems that it is asked to attack. Despite staff reductions, budget limitations, travel restrictions, and other impediments, *the research goes on*—well planned, effective, and efficiently carried out.

"This strong continuity and success at the scientists' level continues to give me a great deal of satisfaction. It attests to the strength and soundness of the SEA-AR organization and to the quality of its people. A well-organized agency, with a strong program and staff, can overcome a variety of adversities and still accomplish its objectives.

"I hope that everyone will continue to feel free to visit, call, and correspond. Not only have I enjoyed such contacts during the past months, but they also have been encouraging to the whole family—they mean a great deal to those of us who have been so 'deeply involved' for so many years.

"One of the real advantages of continuing to live in the Washington area after retirement is the fact that your many friendships can be maintained as folks come to or through Washington for meetings and other business.

"Most important of all," he concludes, "just keep up the good research that SEA-AR has been famous for. A record of success will never be overlooked or forgotten."

On October 1, 1980, the Edminster family helped Ed celebrate his 60th birthday. To "Mr. Ag. Research" from employees of SEA-AR—and the many others who know him throughout USDA—go wishes for a hearty and healthful "Happy Birthday." (By Stu Sutherland, SEA, Washington, D.C.)